REMOTE SENSING OF ICY GALILEAN MOON SURFACE AND ATMOSPHERIC COMPOSITION USING LOW ENERGY (1 eV- 4 keV) NEUTRAL ATOM IMAGING.

M. R. Collier[1], E. Sittler, D. Chornay, J. F. Cooper, M. Coplan, R. E. Johnson
[1]NASA/GSFC Building 21 Room 246, Code 692, Greenbelt, MD 20771 United States
mcollier@pop600.gsfc.nasa.gov

We describe a low energy neutral atom imager suitable for composition measurements at Europa and other icy Galilean moons in the Jovian magnetosphere. This instrument employs conversion surface technology and is sensitive to either neutrals converted to negative ions, neutrals converted to positive ions and the positive ions themselves depending on the power supply. On a mission such as the Jupiter Icy Moons Orbiter (JIMO), two back-to-back sensors would be flown with separate power supplies fitted to the neutral atom and ion/neutral atom sides. This will allow both remote imaging of 1 eV $< E <$ 4 keV neutrals from icy moon surfaces and atmospheres, and in situ measurements of ions at similar energies in the moon ionospheres and Jovian magnetospheric plasma. The instrument provides composition measurements of the neutrals and ions that enter the spectrometer with a mass resolution dependent on the time-of-flight subsystem and is capable of resolving molecules. The lower energy neutrals, up to tens of eV, arise from atoms and molecules sputtered off the moon surfaces and out of the moon atmospheres by impacts of more energetic (keV to MeV) ions from the magnetosphere. Direct Simulation Monte Carlo (DSMC) models are used to convert measured neutral abundances to compositional distributions of primary and trace species in the sputtered surfaces and atmospheres. The escaping neutrals can also be detected as ions after photo- or plasma-ionization and pickup. Higher energy, keV neutrals come from charge exchange of magnetospheric ions in the moon atmospheres and provide information on atmospheric structure. At the jovicentric orbits of the icy moons the presence of toroidal gas clouds, as detected at Europa's orbit, provide further opportunities to analyze both the composition of neutrals and ions originating from the moon surfaces, and the characteristics of magnetospheric ions interacting with neutral cloud material. Charge exchange of low energy ions near the moons, and directional distributions of the resultant neutrals, allow indirect global mapping of magnetic field structures around the moons. Temporal variation of the magnetic structures can be linked to induced magnetic fields associated with subsurface oceans.